

REMARKS-General

The applicants have amended drawing sheet of FIG.5 and claim 2 so as to overcome the technical objections and define the invention patentably over the prior art. The applicants request reconsideration of the rejected claims. Furthermore the applicants disclose, with this response to the Office Action, a newly discovered prior art. The newly disclosed prior art, with relative Information Disclosure Statement form, is attached to the present response to Office Action.

The claim objections

Claim 2 is objected because of informalities.

The claim 2 has been amended as suggested by the Examiner.

The claim rejection under 35 USC §102.

The claims 1, 4, and 5 were rejected as being anticipated by Bibyk (US 6,202,198).

Applicants request reconsideration of this rejection for the following reasons:

1 Prior art reference lacks elements claimed in the present invention.

Reference Bibyk describes, as prior art, a very general system of processing a signal with digital means and driving an actuator, similar in some respects with the subject invention, but it clearly distinguishes from the subject invention for the following aspects:

1.1 The cited reference does not refer to motor control servo systems.

In Bibyk, Figure 1, the disclosed block schematic diagram is a conventional analog sensing system with conversion to digital format, treated by digital computer and returned to an analog output (col.4, ¶ 36-39). This system is not a closed loop system as, in fact, it specifically refers to codecs devices (col.2, ¶. 25) circuits used in the areas of speech and video systems (col.2, ¶. 24).

These systems are generally implemented with complex circuits that sense voice and or images whose analog signals are converted into digital and processed by full computer systems before being reconverted into analog signal for the actuator. The typical example is the telephone system which comprises a microphone (represented by the sensor of FIG.1), the entire telecommunication system (represented by the circuit 18 of FIG.1) and the telephone loudspeaker (represented by the actuator of FIG.1). The generic block 10 indicated in FIG.1 as "Physical Phenomenon" would be represented by the user of the telephone device. The use of oversampling converters, especially in the area of audio signal processing where the required signal bandwidth is limited, certainly represents prior art being a very conventional means of converting signals. The cited reference does not make mention of

motor positioning or general control systems, where kinetic physical parameters like position, velocity and acceleration are tightly controlled to operate systems like hard disk drives, optical data storage devices, printer motors and robotics actuators.

1.2 The cited reference does not refer to closed loop systems.

Bibyk fails to teach how the prior art system of FIG.1 could be construed as a closed loop system and more specifically as a servo loop. The presence of a closed loop system to accurately control the kinetic physical parameter of the motor, as described in the subject invention, is not represented in Bibyk, and certainly one skilled in the art can not directly infer that the signal processing system described in Bibyk could encompass a motor positioning servo loop implementation.

1.3 The cited reference makes use of an analog to digital converter not used in the subject invention.

Generally magnetic and optical data storage devices do not include an analog to digital converter because the kinetic parameters of an element of the motor are detected through the readings of the data on the media. The servo signal is therefore in a digital form (without the need for a conversion) and after being processed is converted by a digital to analog converter to drive the motor in order to control position, velocity and acceleration. This represents a further major difference with cited reference Bibyk, for which the system of FIG.1 clearly differentiates from the subject invention.

1.4 The cited reference makes explicit reference to audio and video systems.

The microprocessor utilized in the motor positioning servo loops of modern data storage devices are mainly formed by two major blocks: the signal detection circuit and the data controller. The signal detection circuit decodes the signal from the media, while the data controller converts the digital data for the transmission to the bus on the host computer. Only a small portion of these digital data represents the signal for the motor control servo loop. In a very dissimilar way, the cited reference Bibyk makes explicit reference to audio and video systems where the digital signal is processed and mainly compressed combining it with mu and A-law encoder functions (col.2, ¶. 20-24) by a digital computer. This represents a further major difference with cited reference Bibyk, for which the system of FIG.1 clearly differentiates from the subject invention.

2 Novelty of the subject invention

The novelty of the subject invention resides in the fact that oversampling data converters are used in motor positioning servo loop systems and that constitutes an innovative method of achieving high performance in the control of the kinetic physical parameters of the actuator. Existing prior art, as cited in the subject application, describes the use of data converters in servo loop systems, but these converters are always implemented utilizing the conventional Nyquist-rate type of digital to analog converters.

Similarly the use of oversampling digital to analog converters is common in other types of system totally different, particularly in signal processing applications and nonanalogous to the motor control servo loop applications.

Therefore the applicants submit that the cited reference (Bibyk) does not anticipate the subject invention and that the use of oversampling converters in motor positioning servo loop systems is novel.

Therefore the applicants submit that Claims 1, 4 and 5 are allowable over the cited reference and respectfully solicit reconsideration and allowance.

The claims rejection under 35 USC §103.

The claims 2, 3 and 6 were rejected as being unpatentable over Bibyk (US 6,202,198). Applicants request reconsideration of these rejections for the following reasons:

3 Official Notice lacks supporting documentary evidence

With respect to the objection of claims 2, 3, and 6 the Examiner takes Official Notice stating that the claims would have been obvious to one having ordinary skills in the art at the time of the invention. However the Official Notice is unsupported by documentary evidence. Furthermore the applicants submit that the use of oversampling data converters is still considered an area of esoteric technology being understood and implemented by a very restricted and limited number of people.

The cited prior art reference is not capable of instant and unquestionable demonstration as being "well known" or reference work recognized as standard in the pertinent art (M.P.E.P. § 2144.03) for the following reasons:

3.1 Prior art Bibyk is nonanalogous art.

The cited reference describes a conventional analog sensing system with conversion to digital format, treated by digital computer and returned to an analog output (col.4, ¶ 36-39). This system is not a closed loop system as, in fact, it specifically refers to codecs devices (col.2, ¶. 25) circuits used in the

areas of speech and video systems (col.2, ¶. 24). The subject invention specifically refers to motor control servo systems whose mere function is to drive the motor in order to accurately control its position, velocity and acceleration. Therefore Bibyk (US 6,202,198) is from different field and it is to be considered nonanalogous art (M.P.E.P. § 2141.01). Furthermore the reference is not reasonably pertinent with the problem that the subject invention addresses.

3.2 Lack of implementation.

With respect to claim 2 and 3, the enumerated advantages of the subject invention in the field of magnetic and optical data storage devices would lead to the consideration that if the implementation of oversampling data converters were obvious to one having ordinary skills in the art at the time of the invention, considering the fact that the provisional patent application was filed almost two years ago (May 2002) it would have been implemented by now. The fact that as of today, people skilled in the art, other than the applicants and the prospective licensees, have not implemented the subject invention despite its numerous and significant advantages, indicates that it is not obvious.

3.3 Impermissible hindsight.

The applicants have contacted several large corporations in the business of motor control for several applications to discuss the validity of the subject invention and possible licensing of the technology and found no evidence that the use of oversampling converters for motor control servo loop system could

have been considered obvious by anyone skilled in the art. The conceptual technological leap to use oversampling data converter for motor control servo loop is significant. The Examiner conclusion of obviousness is based on improper hindsight reasoning (M.P.E.P. § 2145.X) The applicants argue that the Examiner does not take into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and that the Examiner includes knowledge gleaned from the applicant's disclosure.

4 Technical line of reasoning underlying the decision to take the Official Notice is not clear and unmistakable.

With respect to the objection of Claims 2, 3, and 6 the Examiner takes Official Notice stating that the claims would have been obvious to one having ordinary skills in the art at the time of the invention. However the basis for the reasoning according to which the Claims are deemed to be obvious are not set forth explicitly. Specific factual findings predicated on sound technical and scientific reasoning to support the Examiner conclusions are not provided. The Applicants respectfully argue that the Examiner's cited fact is not considered to be common knowledge or well-known in the art (M.P.E.P. § 2144.03) for the following reasons:

4.1 The rationale supporting the rejection under 35 U.S.C. 103 (a) of claims 2 and 3 pertaining to the hard disk drive voice coil motor actuator and to the optical data storage device actuator is non sequitur. The Examiner states:

"It would have been obvious to one having ordinary skill in the art at the time of the invention that the motor actuator of Bibyk would be either a hard disk drive voice coil motor actuator or an optical data storage device actuator because implementing a sigma-delta DAC into both actuators would provide the advantage of shifting unwanted signals to higher frequencies so that unwanted signals can be filtered using low-pass filtering."

The unwanted components to the signal that get shifted to higher frequencies by the oversampling converter of the subject invention are not present in the conventional converters used in these mentioned magnetic and optical data storage systems. The use of Nyquist-rate conventional data converters does not generate high frequency quantization noise therefore, the reasoning that the use of oversampling data converters would be obvious to one having ordinary skills in the art because implementing a sigma-delta DAC into both actuators would provide the advantage of shifting the unwanted high frequency noise so that it can be filtered, is clearly not consequential. On the contrary, the high frequency quantization noise generated by oversampling types of converters would **make the subject invention clearly unobvious** due to the concerns of additional filtering, possible electro-magnetic interference and electrical disturbances of various nature.

4.2 **The rationale supporting the rejection under 35 U.S.C. 103 (a) of claim 6 pertaining to the implementation of the oversampling digital to**

analog converter in software within the microprocessor, although pointing to an advantage of the software implementation of the data converter, does not constitute a valid argument for obviousness of claim

6. The Examiner states:

"It would have been obvious to one having ordinary skill in the art at the time of the invention to implement the DAC of Bibyk in software within the microcontroller because this would allow the DAC to be programmed for different systems having different operating variables and parameters."

If the rationale supporting the claim rejection of obviousness were valid, the software programmability of electrical parameters for any functional block within any electronic system would make obvious the software implementation of any circuit.

The digital to analog converters are, for reasons whose basis and technical implications would be impractical to discuss in this response to OA, typically analog circuits. In particular, the oversampling converters are also generally implemented as analog circuits. The implementation of analog circuits in software is neither practical nor feasible. In some circumstances, like the one described in the subject invention, it is possible to implement the oversampling data converter as a digital circuit, but at present the applicants are unaware of any software implementation. To the best of the applicants' knowledge, at present, there is a plethora of data converters implemented within the microprocessor but they are generally implemented in hardware. In fact the

very high oversampling frequency, when implemented in software, translates in a very high number of instructions per second dedicated to the data converter. The micro-controllers typically used in motor control applications, are mainly devoted to process and convert the data to be then transferred to other sections of the system. When an oversampling data converter is implemented in software, even for higher order of converters, the CPU (Central Processing Unit) is to spend a large portion of its time and computational power to run the software routine of the oversampling data converter. At present, the state of the art in motor control applications is to implement the data converters in hardware. Only very recently, with the advent of parallel processing, and the increase of the processing speed, the software implementation of the oversampling data converter has become possible, but it is certainly not an obvious conceptual step and in particular it is unobvious for the motor control servo loop systems.

5 The present invention gives utility not present in any cited prior art.

The use of oversampling digital to analog converter in motor positioning servo loops is novel and unobvious resolving the problem of controlling with higher resolution the actuator reducing significantly the development and manufacturing costs. No cited prior art includes this functionality.

Taken separately or in combination, no prior art has been disclosed, and no combination or extrapolation of combinations of prior art has been suggested, which provides the utility of the subject invention.

The novel physical features of claim 2, 3 and 6 produce new and unexpected results and hence are unobvious and patentable over these references under § 103.

Therefore the applicants submit that Claims 2, 3 and 6 are allowable over the cited references and respectfully solicit reconsideration and allowance.

Conclusions

For all the above reasons, applicants submit that the drawings and claims are now in proper form, and that the claims all define patentably over the prior art. Therefore they submit that this application is now in condition for allowance, which action they respectfully solicit.

New Disclosure of prior art

The applicants have been in contact and discussing the possible licensing of the subject invention to major international corporations. During the extensive search for prior art executed by one of these companies, a relevant prior art US patent (**Lu et al. US 6,456,450**) was brought to the applicants' attention. The newly disclosed prior art, with relative Information Disclosure Statement form, is attached to the present response to Office Action.

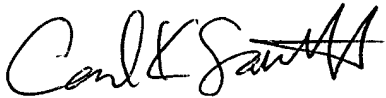
Lu et al. discloses a servo system, specific to the hard disk drive applications, and an apparatus to reduce the motor control inaccuracies due to the digital to analog converter quantization noise. This is achieved by the means of a quantization error feedback that compensates for the reduced resolution caused by the digital to analog converter. This prior art clearly recognizes the difficulty in accurately controlling the voice coil motor (VCM) of a hard disk drive and defines a method to improve the precision of the control device in a way that in some respects could appear topologically similar to the subject invention, but that clearly differentiates from it for the fact that no oversampling system is described. In fact the evident advantage of the subject invention versus the prior art is the fact that the oversampling converters have an inherent lower quantization noise in the signal bandwidth.

The newly disclosed prior art (Lu et al. US 6,456,450) has been recognized to be not anticipating the subject invention, in fact a license agreement has been offered.

Conditional Request For Constructive Assistance

Applicants have amended the drawing sheet of FIG.5 and claim 2 of this application so that they are proper, definite, and define novel structure which is also unobvious. If, for any reason this application is not believed to be in full condition for allowance, applicants respectfully request the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. § 2173.02 and § 707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

Very respectfully,



Carl Sawtell



Paolo Menegoli